

Six new species of *Bonamia* Thouars. (Convolvulaceae) from northern Australia

R.W. Johnson†

Summary

Johnson, R.W. (2014). Six new species of *Bonamia* Thouars. (Convolvulaceae) from northern Australia. *Austrobaileya* 9(2): 292–310. *Bonamia fruticosa* R.W.Johnson, *B. longipilosa* R.W.Johnson, *B. multiflora* R.W.Johnson, *B. pilbarensis* R.W.Johnson, *B. toniae* R.W.Johnson and *B. wilsoniae* R.W.Johnson are described as new and illustrated. Notes on their distribution, including maps, habitat, phenology and affinities are given.

Key Words: Convolvulaceae, *Bonamia*, *Bonamia* section *Breweria*, *Bonamia fruticosa*, *Bonamia longipilosa*, *Bonamia multiflora*, *Bonamia pilbarensis*, *Bonamia toniae*, *Bonamia wilsoniae*, Australia flora, new species, taxonomy

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Introduction

Bonamia Thouars is a predominantly pantropical genus of over 60 species. The genus was established in 1804, based on a Madagascan species. Brown (1810) described the genus *Breweria* R.Br., comprising three Australian species, *B. linearis* R.Br., *B. media* R.Br. and *B. pannosa* R.Br. and Mueller (1859) added a further species, *B. rosea* F.Muell. Hallier (1893) united these two genera. Aside from *B. dietrichiana* Hallier f., all Australian species belong to *Bonamia* Section *Breweria* (R.Br.) Myint, characterised by glabrous seeds, shorter peduncles and pedicels, smaller corollas and smaller leaves.

Myint (1968) published an account of the Australasian species of *Bonamia*, describing a new species *B. oblongifolia* Myint. Myint & Ward (1968) revised the genus *Bonamia* worldwide recognising 45 species. Since then three new species from Australia were described by Johnson (1987). Further study in preparing a generic treatment for the *Flora of Australia* has now revealed a further six undescribed species that are diagnosed and illustrated here.

Materials and methods

This work is based on herbarium specimen collections in BRI, DNA and PERTH, with some additional material from NSW and CANB. All specimens cited in this revision have been examined unless indicated otherwise by ‘n.v’. Measurements of leaves and bracts were made from dried herbarium specimens; measurements of floral parts were made from material preserved in spirit or reconstituted with boiling water.

The corolla is sympetalous and mostly funnel-shaped. The length of the corolla and the diameter of the limb are difficult to ascertain on herbarium specimens as the corolla is flattened during pressing. The length of the flattened and dried corolla approaches the petal length and it is for this reason that petal length is given in the species descriptions.

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Taxonomy

1. *Bonamia fruticosa* R.W.Johnson sp. nov., similis *B. pannosae* et *B. multiflorae* autem ambobus capsulis seminibus antherisque magno necnon sepalis comparate latioribus quam eis *B. multiflorae* differt. **Typus:** Western Australia. vicinity of Cone Hill, Cape Domett, 22 March 1978, *T.G. Hartley 14759* (holo: CANB; iso: DNA, PERTH).

Many stemmed **perennial** shrub to 50(200) cm with erect, ascending and prostrate branches, densely hairy, pannose, grey-green; hairs biramous with spreading to erect arms 0.5–1.5 mm long. **Leaves** simple, petiolate; **petiole** 2–15(–25) mm long, 0.2–0.4(–0.5) times as long as blade; **blade** ovate to broadly ovate, ovate-oblong, 16–38(–70) mm long, 9–28(–45) mm wide, length:breadth ratio 1.2–2.4, apex acute to rounded or slightly acuminate, mucronulate, base cuneate, rounded or obtuse, rarely shallowly cordate; with a midrib and 3–5 pair of secondary veins; densely hairy to pannose on both sides, hairs with ascending arms, 0.4–1 mm long (rarely longer). **Inflorescence** axillary, cymose, with 1–5 flowers; **peduncle** ± absent to 0.5 mm long; **bracts** linear, 3–6 mm long, 0.5–0.8 mm wide, densely hairy, persistent; **pedicel** 0.5–2 mm long. **Outer sepals** ovate, broadly ovate to deltoid, 8–14 mm long, 4.3–8 mm wide, slightly longer and broader in fruit, length:breadth ratio 1.2–2.2, acute or slightly acuminate, rounded to obtuse or acute at the base, densely hairy; **inner sepals** narrowly ovate to ovate, 7–12 mm long, 2.3–5 mm wide, slightly larger in fruit, length:breadth ratio 1.6–3.7, acute or acuminate, truncate to sub-cordate at the base, densely hairy along spine and tip with a hyaline basal margin. **Corolla** funnel-shaped, 6–10 mm long, 20–25 mm diameter, blue to purple; **petals** 10–16 mm long, 7–12 mm wide at limb, rounded, emarginate, apiculate; mid-petaline bands hairy for 5.5–10 mm from tip. **Stamens** 5; filaments unequal in length, adnate for 2–3.5 mm from base of corolla tube, free for 3.5–8 mm, fused-base winged, with tubercles and hairs to 0.25 mm long above and below the point of attachment; **anthers** oblong to ovate-oblong, 2.1–2.8 mm long 0.7–1 mm wide,

rounded, emarginate at the apex, sagittate, with basal lobes 0.5–1 mm long. **Ovary** oblong-globular, on a small disk, 2-locular, 1.2–2 mm long, densely hairy with erect hairs mainly confined to the upper half; **styles** 2, unequal, 5.3–8 mm long, connate in the lower 1–3.5 mm, glabrous, each with a sub-globose capitate stigma. **Capsule** ovoid, 7–8 mm long, 6–7.5 mm diameter, with a tuft of erect hairs to 1.5 mm long at the tip, circumscissile and 4-valved; **seeds** 4–5.5 mm long, 2.9–3.5 mm across, glabrous, brown to black, wingless or with narrow wing (<0.1 mm wide) or low tubercles one margin. **Figs. 1, 2A, 3E–H.**

Additional specimens examined: Western Australia. WSW of Cape Londonderry, Aug 1975, *George 13389* (PERTH); Cape Domett, N of Wyndham, Jun 2003, *Kenneally 11889* (PERTH); vicinity of Cone Hill, Cape Domett, Mar 1978, *Hartley 14759* (CANB, DNA, PERTH); 7 km W of Mitchell Plateau turnoff from Gibb River – Mitchell Plateau Road, May 1981, *Tracey 13918* (BRI); King Edward River crossing on Mitchell Plateau Road, Jun 1984, *Craven 8449* (CANB); 80 km N of Kununurra, E side of main road, Mar 1992, *Mitchell 2136* (BRI, PERTH); King Edward River, old RCA campsite, 1 km S of track to Old Mitchell River Station, Jun 1988, *Edinger 598* (PERTH); 6 miles [c. 9.6 km] S of Wyndham, in 1969, *Mackenzie 690316-32* (CANB); 1 km W of Cotton Ginney, Kununurra, Mar 1979, *Andrew 418* (DNA); new Cockatoo sand site, CSIRO Kununurra, Jul 1978, *Andrew 60* (DNA); Kununurra, Apr 1971, *Black 17* (PERTH); near Lily Creek, 1 km E of Kununurra, Mar 1978, *Pajmans 2341* (CANB); Mirima NP (W of Park entrance gate), Dec 1999, *Handasyde TH99 478* (PERTH); 5 km N of Kununurra, Jan 1979, *Petheram (AAM)260* (DNA, PERTH); vicinity of Kimberley Research Station, Kununurra, in 1969, *Mackenzie 690312-25* (CANB); 8 km S of Kununurra, Mar 1978, *Pajmans 2398* (CANB); 24 km NE of Dunham River Homestead, Mar 1978, *Lazarides 8530* (BRI, CANB, DNA, PERTH); Meda – Oobagooma Road, 59 km by road N of Gibb River Road, Jun 1976, *Beaglehole ACB52705* (PERTH). Northern Territory. Spirit Hills, Apr 1998, *Harwood & Brocklehurst 418* (DNA); ditto loc., Apr 1998, *Harwood & Brocklehurst 420* (DNA).

Distribution and habitat: This species occurs in north-western Australia from near Derby, Western Australia to Spirit Hills Wilderness Conservation area (near the W.A./N.T. border), Northern Territory (**Map 1**). It grows in savannah woodlands on sandy soils.

Affinities: *Bonamia fruticosa* is similar to *B. pannosa* (R.Br.) Hallier f. and *B. multiflora* R.W.Johnson. It differs from both species by having larger capsules, seeds and anthers.



Fig. 1. Holotype of *Bonamia fruticosa* [Hartley 14759 (CANB)].

Table 1. Comparison of some morphological characters between *Bonamia fruticosa*, *B. multiflora* and *B. pannosa*

Character	<i>B. fruticosa</i>	<i>B. multiflora</i>	<i>B. pannosa</i>
Outer sepal shape; size (mm); length: breadth ratio	narrowly ovate to ovate or elliptic; 8–14 × 4.3–8; 1.2–2.2	ovate, broadly ovate to deltoid; 8–14 × 2.5–6; 2.1–4.4	very broadly ovate to deltoid; (7–)9–12 × (4–)7–10; 1–1.8
Anther length (mm)	2.1–2.8	1.4–1.8	1.1–1.8
Capsule size (mm)	7–8 × 6–7.5	4.5–6.5 × 3–5	4–5.5 × 3.7–4.5
Seed size (mm)	4–4.6 × 2.9–3.5	2.6–3.8 × 2–2.9	2.4–3.3 × 1.8–2.5

Bonamia fruticosa also has relatively broader outer sepals than *B. multiflora*. These differences are summarized in **Table 1**. *Bonamia fruticosa* has a much more robust shrubby habit and semi-woody stems that are much tougher than the more herbaceous stems of *B. pannosa*.

Conservation status: *Bonamia fruticosa* is widely distributed in the Kimberley, Western Australia and is not considered to be threatened.

Etymology: The specific epithet is from the Latin *fruticosus*, shrubby, referring to the habit of this species.

2. *Bonamia longipilosa* R.W.Johnson sp. nov., similis *B. mediae* et *B. brevifoliae* autem ambobus habitu compactiore internodiis brevioribus differt et pilos longiores in foliis caulibusque gerit. *Bonamia brevifolia* vestimento sine pilis semi-appressis in caulibus et pagina inferior foliorum differt. **Typus:** Queensland. BURKE DISTRICT: on track between Musselbrook Mining Camp (175 km N of Camooweal) and Musselbrook Gorge, 30 April 1995, *M.B. Thomas & R.W. Johnson MRS659* (holo: BRI; iso: DNA, MEL).

Bonamia sp. (Lawn Hill R.J.Cumming 17533); Johnson (2007: 51, 2010: 46).

Perennial with short trailing stems from a central taproot; **stems** slender, sparsely to moderately densely hairy; hairs biramous with ascending arms, mainly 0.8–2 mm long. **Leaves** simple, petiolate, crowded with short internodes; **petiole** 1–4 mm long, 0.1–0.3 times as long as the blade; **blade** ovate to broadly ovate, 6–17 mm long, 4–13 mm

wide, length: breadth ratio 1–1.6, apex obtuse, mucronulate, base broadly cuneate to rounded or subcordate; with a midrib and 2 or 3 pairs of secondary veins; moderately densely hairy on both sides becoming sparse, hairs with arms mainly 0.8–2 mm long. **Inflorescence** axillary, cymose, with 1–2 flowers; **peduncle** ±absent; **bracts** opposite, linear to narrowly obovate, acute, 3.5–5 mm long, 0.4–0.8 mm wide, persistent; **pedicel** 0.5–2(–4) mm long. **Outer sepals** narrowly ovate, ovate, to ovate elliptic, slightly asymmetric, 6–8 mm long, 2.5–3 mm wide, length: breadth 2.2–2.7, apex acute, base rounded to truncate, moderately dense to densely hairy, hairs with arms 0.3–1.3 mm long; **inner sepals** ovate, 4.5–6.5 mm long, 1.5–2.5 mm wide, length: breadth 2.5–3.3, apex acute to acuminate, base rounded to truncate, hairy along the medial line with a glabrous hyaline margin at the base. **Corolla** funnel-shaped, 7–10 mm long, 10–14 mm diameter, blue; **petals** 10–12 mm long, 6–7 mm across at the limb, distally rounded, emarginate, midpetaline bands hairy for 3–6 mm from the tip. **Stamens** 5; filaments unequal in length, adnate for 2.5–3 mm from the base of corolla tube, free for 3.5–5.5 mm, fused-base winged with scattered hairs and tubercles mainly on the margin and extending above the point of attachment; **anthers** oblong to elliptic, 1.2–1.4 mm long, apex emarginate, base sagittate, basal lobes 0.4–0.6 mm long. **Ovary** globular-ovoid, on a small disk, 2-locular, 0.8–1 mm long, glabrous, except for long hairs towards the tip; **styles** 2, unequal, 6–8 mm long, connate in the lower c. 3 mm, glabrous, each with a subglobose-capitate stigma. **Capsule** globular-ovoid, 4–4.5 mm long, 3.5–4 mm diameter, circumscissile,

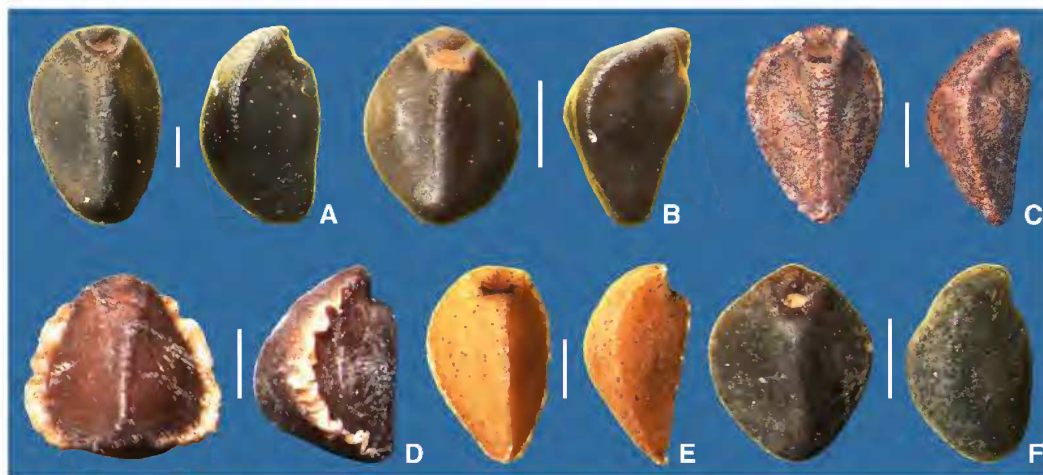


Fig 2. Seeds of *Bonamia* species, ventral and lateral view. **A.** *B. fruticosa* [Mackenzie 690312-25 (CANB)], **B.** *B. longipilosa* [McDonald KRM2286 & Covacevich (BRI)], **C.** *B. multiflora* [Johnson & Thomas MRS910 (BRI)], **D.** *B. pilbarensis* [Mitchell PRP217 (BRI)], **E.** *B. toniae* (McDonald KRM7704 & Covacevich (BRI)), **F.** *B. wilsoniae* [Wilson 5231 (NSW)]. Scale bars = 1 mm.

4–8-valved, with some hairs at the apex; **seeds** 2.2–2.8 mm long, 1.5–2 mm across, glabrous, granular, mid-brown to black, wingless. **Figs. 2B, 4, 5D–G.**

Additional selected specimens (from 28 examined):

Northern Territory. c. 40 km NW of Kalkaringi, Apr 2012, *Lewis 1984* (BRI). **Queensland.** BURKE DISTRICT: 11 Mile Creek, Normanton – Karumba Road, Mar 2001, *McDonald KRM770* (BRI) [atypical]; Melville Creek, 10 km N of Normanton, Jan 2005, *McDonald KRM3435* (BRI) [atypical]; Normanton – Burketown Road, Jan 2001, *McDonald KRM693* (BRI); 9 km from Normanton on Croydon Road, Apr 1999, *Milson 1465* (BRI); 3 km along Croydon Road, 8 km SSW of Normanton, Apr 1993, *Purvis & Milson IP13* (BRI); c. 11 km from Normanton towards Croydon, Apr 2004, *McDonald KRM2264 & Covacevich* (BRI); Normanton, May 1935, *Blake 9168* (BRI); 23 km S of Normanton on Cloncurry – Normanton Road, Mar 1977, *Schmid ASI39* (BRI); 27.7 km along Burke Development Road from junction with Croydon – Normanton Road, May 2004, *McDonald KRM2286 & Covacevich* (BRI); Haydon Creek between Croydon & Normanton, Apr 2008, *McDonald KRM7588* (BRI) [atypical]; Burketown – Normanton Road, 16 miles [26 km] E of Wernadinga Homestead, Oct 1968, *Williams 194* (BRI); 79.2 km by road W of Georgetown on E flank of Gregory Range, Mar 2006, *McDonald KRM4946* (BRI); 200 m along Richmond Road from junction with Georgetown – Croydon Road, Apr 2004, *McDonald KRM2237 & Covacevich* (BRI); 9.1 km by road W of Gilbert River Road crossing, Gregory Range, Jan 2005, *McDonald KRM3401* (BRI); 7.5 km by road E of Croydon Post Office, Jan 2005, *McDonald KRM3406*

(BRI); 41.9 km E of Croydon near Maitland Creek on Gregory Range, Feb 2006, *McDonald KRM4831* (BRI); Bang Bang jump-up, 103 km from junction of Croydon – Normanton Road, May 2004, *McDonald KRM2295 & Covacevich* (BRI); 17.6 km on Augustus Downs Road from junction at Burke Development Road, Apr 2008, *McDonald KRM7615* (BRI); 28.2 km S by road from Musselbrook Mining Camp on road to Camooweal, Apr 1995, *Thomas & Johnson MRS427* (BRI); 30 km SW of Lawn Hill Gorge on Norfolk – Highland Plains Road, Jun 1998, *Cumming 17533* (BRI); 9.5 km by road to Julia Creek from junction with Burke Development Road, Mar 2005, *McDonald KRM4072* (BRI).

Distribution and habitat: The species occurs near Kalkaringi, Northern Territory and in north-west Queensland, south of the Gulf of Carpentaria, from the Musselbrook – Lawn Hill area to the east of Normanton, towards the Gregory Range (**Map 2**). It grows on alluvial plains and low rises, occasionally on sandstone and lateritic plateaux. It is commonly found on sandy soils, often skeletal and stony, supporting eucalypt, *Acacia* and mixed species woodlands and open woodlands, often with a shrubby understorey.

Phenology: Flowers have been recorded from January to May, also in October, with fruits more common from April to June.

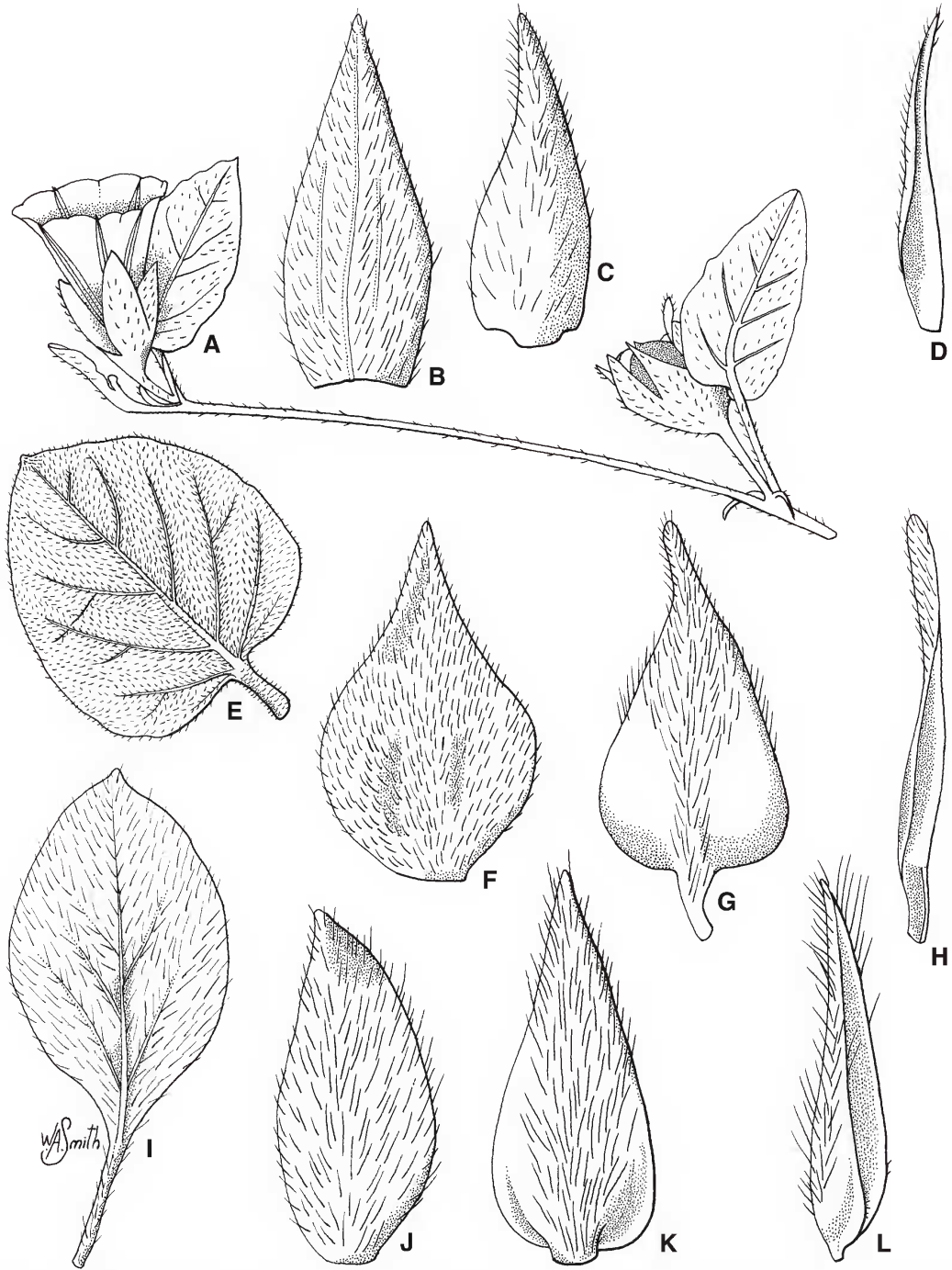


Fig. 3. *Bonamia wilsoniae* A. flowering branchlet $\times 3$. B. outer sepal at flowering (abaxial view) $\times 8$. C. inner sepal at flowering (abaxial view) $\times 8$. D. inner sepal at flowering (lateral view) $\times 8$. *B. fruticosa* E. leaf $\times 1$. F. outer sepal at flowering (abaxial view) $\times 4$. G. inner sepal at flowering (abaxial view) $\times 6$. H. inner sepal at flowering (lateral view) $\times 6$. *B. pilbarensis* I. leaf $\times 3$. J. outer sepal at flowering (abaxial view) $\times 8$. K. inner sepal at flowering (abaxial view) $\times 8$. L. inner sepal at flowering (lateral view) $\times 8$. A–D from Wilson 4792 (NSW); E–H from Pajmans 2341 (CANB); I–L from Long VL1494 09 (PERTH). Del. W. Smith.



Fig. 4. Representative specimen of *Bonamia longipilosa* [McDonald KRM2237 & Covacevich (BRI)].

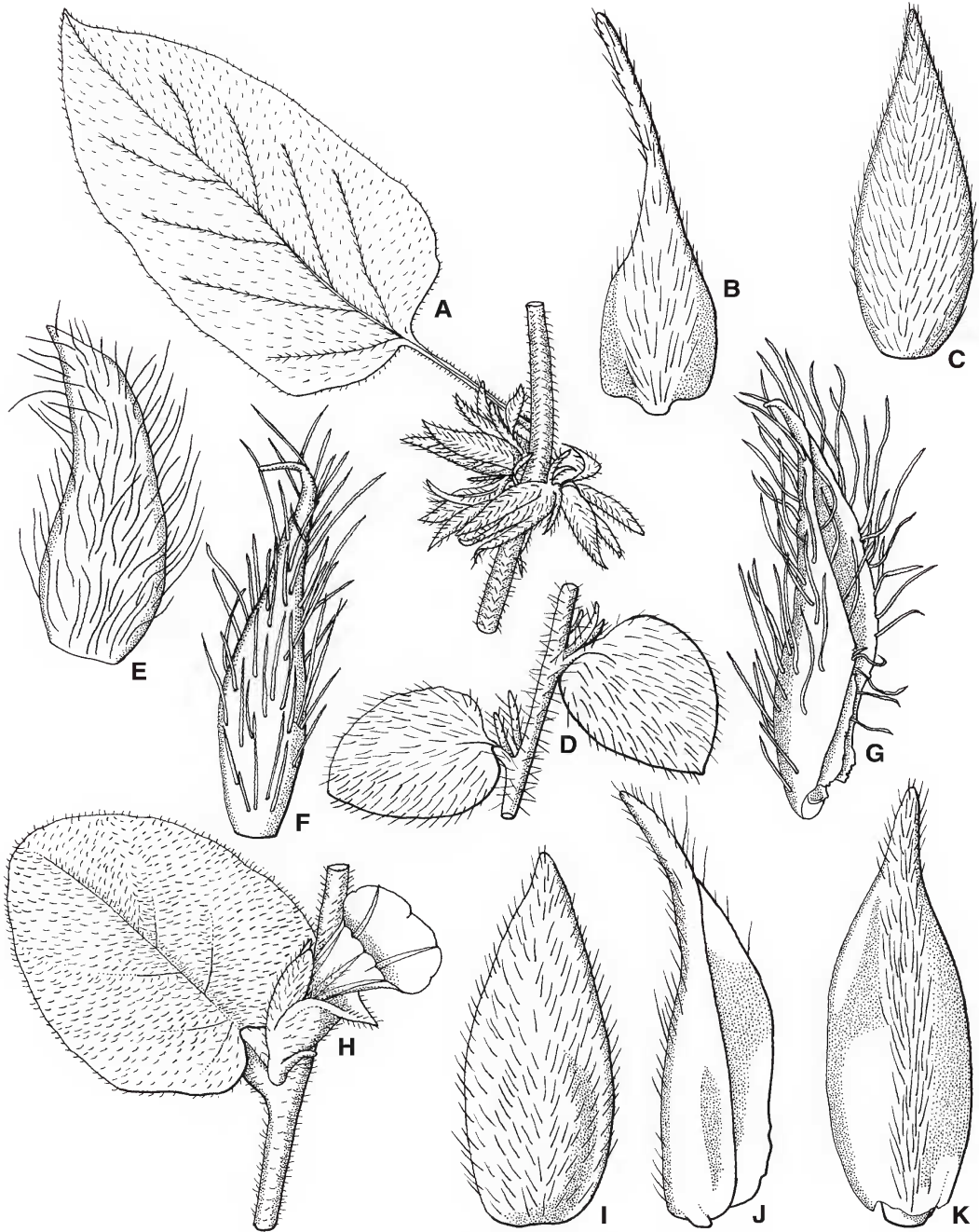


Fig. 5. *Bonamia multiflora* A. portion of branchlet with immature fruits $\times 1.5$. B. inner sepal at flowering (abaxial view) $\times 8$. C. outer sepals at flowering (abaxial view) $\times 4$. *B. longipilosa* D. branchlet $\times 3$. E. outer sepal at flowering (abaxial view) $\times 8$. F. inner sepal at flowering (abaxial view) $\times 12$. G. inner sepal at flowering (lateral view) $\times 12$. *B. toniae* H. flowering branchlet $\times 3$. I. outer sepal at flowering (abaxial view) $\times 8$. J. inner sepal at flowering (lateral view) $\times 12$. K. inner sepal at flowering (abaxial view) $\times 12$. A–C from McDonald KRM 1089 (BRI); D from McDonald KRM2237 & Covacevich (BRI); E–G from McDonald KRM4946 (BRI); H–K from McDonald KRM14100 (BRI). Del. W. Smith.

Affinities: *Bonamia longipilosa* is similar to *B. media* (R.Br.) Hallier f., and *B. brevifolia* (Benth.) Myint. It differs from both species in having a more compact habit with shorter internodes and bears much longer hairs on leaves and stems. *Bonamia longipilosa* differs from *B. brevifolia* in vestiture, without the moderately dense cover of semi-appressed hairs on the stems under underside of leaves.

Conservation Status: *Bonamia longipilosa* is widely distributed in north-western Queensland and is not considered to be threatened.

Etymology: The specific epithet is from the Latin *longus*, long, and *pilosus*, pilose, referring to the long hairs on the leaves and stems.

3. *Bonamia multiflora* R.W.Johnson, **sp. nov.**, arte affinis *B. pannosae* et in ea includa in herbariis et in revisione (Myint & Ward 1968). *Bonamia pannosa* prostrata ramis serpentibus et floribus exterioribus latissime ovatis usque deltoideis, ex contrario *B. multiflora* plus semi-erecta demum decumbens et sepalis exterioribus anguste ovatis ellipticisve ≤ 6 mm latis. *Bonamia multiflora* habitu similari *B. fruticosum* autem capsulis seminibus antherisque minoribus differt. **Typus:** Queensland. BURKE DISTRICT: 27 km by road, NE of Musselbrook Mining Camp, 175 km N of Camooweal, 30 April 1995, M.B. Thomas & R.W. Johnson MRS639 (holo: BRI; iso: DNA, MEL).

Bonamia sp. (Musselbrook M.B.Thomas+ MRS639); Johnson (2007: 51, 2010: 46).

Bonamia sp. (Chillagoe K.R.McDonald KRM334); Johnson (2007: 51, 2010: 46).

Perennial with erect, tufted stems to 0.7 m, becoming procumbent and trailing or stems prostrate radiating from a central taproot; **stems** densely hairy, often pannose, grey-green; hairs biramous with ascending arms 0.2–1.5 mm long. **Leaves** simple, petiolate; **petiole** 2–22 mm long, 0.1–0.6 times as long as the blade; **blade** ovate to broadly ovate, ovate-oblong, ovate-elliptic or elliptic to broadly elliptic, 20–65 mm long, 7.5–40 mm wide, length:breadth ratio 1.3–4, apex

obtuse, acute or acuminate, mucronulate, base rounded to almost truncate, subcordate or cuneate to obtuse; midrib and 4–5 secondary veins usually distinct on lower surface; densely hairy to pannose on both sides, hairs with ascending arms 0.5–1.3 mm long. **Inflorescence** axillary, cymose, with 2–8 flowers; **peduncle** 1–5 mm long or \pm absent; **bracts** opposite, linear to linear-obovate, 4–14 mm long, 0.4–1.6 mm wide, acute, persistent; **pedicel** up to 2 mm long or \pm absent. **Outer sepals** narrowly ovate to ovate or elliptic, 8–14 mm long, 2.5–6 mm wide, length:breadth ratio 2.1–4.4, slightly longer and broader in fruit, acute or slightly acuminate at the apex, tapering at the base, densely hairy or pannose with hairs arms to 1 mm long; **inner sepals** narrowly ovate to narrowly triangular, 6–10 mm long, 1.6–3.8 mm wide, length:breadth ratio 2–3.8, slightly larger in fruit, apex acute or long acuminate, rounded-truncate to subcordate at the base, densely hairy along the medial line, with a hyaline margin at the base. **Corolla** funnel-shaped or urceolate, 7–10 mm long, 9–17 mm diameter, white, pale blue to purple; **petals** 8–15 mm long, 4.5–9 mm across at the limb, rounded, emarginate, apiculate, midpetaline bands hairy for 4–8 mm from the tip. **Stamens** 5, filaments unequal in length, adnate for 1.5–4 mm from the base of the corolla tube, free for 2.8–6.5 mm, fused-base winged with scattered tubercles mainly on the margin and longer hairs to 0.3 mm long about the point of attachment; **anthers** oblong to ovate-oblong or oblong-elliptic, 1.4–1.8 mm long, apex rounded, emarginate, base sagittate, basal lobes blunt, 0.4–0.6 mm long. **Ovary** cylindrical, on a small disk, 2-locular, 1.5–2 mm long, hairy mainly in the upper half; **styles** 2, unequal, 4–9 mm long, connate in the lower 2–3.8 mm, glabrous, each with a subglobose-capitate stigma. **Capsule** globular-ovoid, 4.5–6.5 mm long, 3–5 mm diameter, circumscissile and 4-valved, with a persistent style base and a tuft of erect hairs at the apex; **seeds** 2.6–3.8 mm long, 2–2.9 mm across, glabrous, finely and uniformly tuberculate, red-brown to dark brown or black, wingless or with narrow thick wing, to 0.1 mm wide, slightly paler than seed surface,



Fig. 6. Representative specimen of *Bonamia multiflora* [Bean 23733 (BRI)].

on one or both margins. **Figs. 2C, 5A–C, 6.**

Additional selected specimens (from c. 120 examined).

Northern Territory. Kabulwarnamyo O/S, upper Liverpool River, Arnhem Land, Apr 2003, *Russell-Smith 10650* (DNA); headwaters of the Cadell River, c. 82 km SSE of Maningrida, Apr 2000, *Cowie 8844* (DNA); 10 km N of Jim Jim Falls, May 1980, *Craven 6074* (CANB); c. 7 miles [c. 11.2 km] NE of El Sharana Mine, Feb 1973, *Lazarides 7865* (CANB, DNA); Kakadu NP, Birdie Creek, Apr 1990, *Cowie & Leach 1097* (BRI); Limmen NP, turnoff to Limmen River Store and fishing camp, Apr 2008, *Dixon 1792* (DNA); Lorella Station, Jun 1986, *Wilson 16* (DNA); 10 miles [c. 16 km] W Borrooloola, Jun 1971, *Henry 056* (BRI); 15 km S of Elliott, Jan 1993, *Egan 1334* (BRI); Border Waterhole, Jul 1971, *Latz 1632* (BRI). **Queensland.** COOK DISTRICT: Dixie Station, SW of Musgrave, Jul 2008, *McDonald KRM7777* (BRI); 28.7 km by road from Chillagoe on Walsh River road, Rookwood Creek catchment, Mar 2004, *McDonald KRM1851* (BRI); between Burke Development Road junction & Gingerella on Mt Surprise road, Mar 2005, *McDonald KRM3681 et al.* (BRI); Newcastle Range, 46.6 km by road to Abingdon Downs from Gulf Development Road, Jan 2008, *McDonald KRM7197* (BRI); 'Mount Surprise', Elizabeth Creek area, off Six Mile Road, Apr 1992, *Champion 672A* (BRI). BURKE DISTRICT: 64 km East of Burketown on Wernadinga Station, May 2003, *Thompson & Newton BUR099* (BRI); Murray Springs, 12.1 km W by road of Musselbrook Mining Camp, May 1995, *Johnson & Thomas MRS910* (BRI); just N of Musselbrook Mining Camp near old dam, May 1995, *Thomas & Johnson MRS971* (BRI); Border Waterhole, Highland Plains Station, Jul 1992, *McDonald KM1089 & Johnson* (BRI); Middle Park, N of Richmond, Jun 1999, *Bean 14974* (BRI); 34 km from Camooweal, towards Mt Isa, May 2005, *Bean 23733* (BRI); Lady Loretta Road, 65 km NE of Mt Isa, Apr 1998, *Barrs SB211* (BRI); Upper Stone-axe Creek, 25 km N of Mt Isa, May 1989, *Harris 391* (BRI).

Distribution and habitat: The species occurs from Pine Creek and Kakadu NP, Northern Territory to the southern parts of the Gulf of Carpentaria and east to the Great Dividing Range from west of Cooktown, south to southwest of Chillagoe and west of Ayr, Queensland (**Map 1**). It is found on sandstone escarpments to rocky rises and granitic hills and tablelands, and associated creek flats. It grows in open *Eucalyptus* woodlands, especially *Eucalyptus leucophloia* low open woodlands with *Acacia* and *Triodia*, and in *Acacia* woodlands, especially *A. shirleyi*. It is found on stony and gravelly sandy soils from deep to skeletal, mainly derived from sandstone or granite.

Phenology: Flowers recorded from December to July, with fruiting occurring mainly April to July.

Affinities: *Bonamia multiflora* is closely related to *B. pannosa* and has been included under *B. pannosa* in herbaria and in the revision of Myint & Ward (1968). *Bonamia pannosa* is usually a prostrate plant with trailing branches. *Bonamia multiflora* has a more semi-erect stature becoming decumbent with age. The shape of the outer sepals is markedly different with *B. pannosa* having very broad ovate to deltoid outer sepals usually greater than 7 mm in breadth whereas *B. multiflora* has narrowly ovate to ovate or elliptic outer sepals ≤ 6 mm wide. *Bonamia multiflora* also resembles *B. fruticosa* with a similar habit but differs from that by having smaller capsules, seeds and anthers. These differences are summarized in **Table 1**.

Conservation Status: *Bonamia multiflora* is a widespread species and not known to be threatened.

Etymology: The specific epithet refers to many-flowered inflorescences of this species.

4. *Bonamia pilbarensis* R.W.Johnson sp. nov., quoad semina alis angustis praedita *B. alatisemini* similis autem foliis late ellipticis vel orbicularibus in ambitu et petiolis longioribus a hac differt. Ea olim cum *B. media* confusa autem seminibus alatis distinguenda. **Typus:** Western Australia. c. 40 km S of Dampier on Hamersley Iron Railway Line Road, 1 Apr 1995, *A.A. Mitchell PRP217* (holo: BRI; iso: PERTH *n.v.*).

Bonamia sp. Dampier (A.A. Mitchell PRP217); Western Australian Herbarium (2012).

Perennial plant with trailing stems; stems slender, moderately to densely hairy; hairs biramous with ascending arms; arms 0.5–1 mm long, occasionally longer. **Leaves** simple, petiolate; **petiole** 4–12 mm long, 0.3–0.7 times as long as the blade; **blade** elliptic to broadly elliptic or \pm orbicular, 7–23 mm long, 5–16 mm wide, length:breadth ratio 1.1–2, apex barely acute to rounded, mucronulate, base attenuate to rounded; midrib and 3–4 pairs of secondary veins distinct on

lower surface; moderately to densely hairy. **Inflorescence** axillary, 1-flowered; **peduncle** to 0.5 mm or absent; **bracts** linear or narrowly oblanceolate, acute, 1.5–3 mm long, 0.1–0.3 mm wide persistent; **pedicel** terete or slightly dilated distally, 1–10 mm long. **Outer sepals** ovate, slightly asymmetric, 5.5–8 mm long, 2.5–3.5 mm wide, length: breadth ratio 2.2–2.5, slightly longer and broader in fruit, acute to shortly acuminate, obtuse to rounded at the base, moderately dense to densely hairy, hairs with arms mainly 0.3–1.1 mm long; **inner sepals** narrowly ovate, 6.5–8.5 mm long, 2–3.2 mm wide, length: breadth ratio 2.5–3.4, apex acute to acuminate, base rounded to sub-cordate, hairy along the medial line with a hyaline margin at the base. **Corolla** funnel-shaped, 10–25 mm long, 12–25 mm diameter, blue to bluish-purple, rarely white; **petals** 11–28 mm long, 9–14 mm across at the limb, distally rounded, depressed, mucronulate, midpetaline bands hairy for 5–8 mm from the tip. **Stamens** 5; filaments unequal in length, adnate for 2–4.7 mm from the base of the corolla tube, free for 2.5–5.5 mm, fused-base winged with scattered hairs and tubercles mainly on the margin and hairs to 0.5 mm about the point of attachment; **anthers** ovate-oblong to oblong, 1.1–1.5 mm long, apex emarginate, base sagittate, basal lobes blunt, 0.2–0.6 mm long. **Ovary** ellipsoidal, on a small disk, 2 locular, 1–1.3 mm long, glabrous, except for long hairs at the base of the style; **styles** 2, unequal, 4.7–7.5 mm long, connate in the lower 1.5–4 mm, glabrous, each with a subglobose-capitate stigma. **Capsule** globular-ovoid, 4–5.5 mm tall, 4–5 mm across, glabrous or with some hairs at the apex; **seeds** 2.3–3.5 mm long, 1.7–2.6 mm across, finely punctate, glabrous, mid-brown to black, with a distinct undulate wing along margins; wing paler than seed surface, 0.2–0.4 mm wide. **Figs. 2D, 3I–L, 7.**

Additional specimens examined: Western Australia. site 4, further S along track S of Deep Gully, SW of Hearson Cove, Mar 2009, *Long VL1494 09* (PERTH); Rear Burrup, Apr 1982, *Glennon 137* (PERTH); Burrup Peninsula, Jul 1981, *Blackwell BP87* (PERTH); Epic Energy LNG lateral pipeline to Wodgina mine, c. 100 km W of Port Hedland, S of North West Highway, Apr 2001, *Coultas 21-6* (PERTH); *ditto loc.*, Apr 2001, *Coultas 30-3* (PERTH); c. 40 km S of Dampier on Hamersley Iron Railway line road, Apr 1995, *Mitchell*

PRP217 (BRI); Wallareenya Station, c. 80 km due S of Port Hedland, Sep 2006, *Halford Q9165* (BRI); Wogina [Wodgina] Road, 90 km S of Port Hedland, Sep 2008, *Carroll 4* (PERTH); Marble Bar, *s.dat.*, *Groves 8* (PERTH); 1.2 km SW of Coongan River crossing, near Marble Bar, Apr 2006, *Bean 25195* (BRI, PERTH); 6 km NW of Panawonica [Pannawonica] Hill, Panawonica [Pannawonica] Road, Mar 1984, *Newbey 9900* (BRI); c. 43 km W of Mt Florence homestead on N margin of Fortescue plain, Sep 1995, *Mitchell PRP781* (BRI, PERTH); back road to gorges, Karijini [formerly Hamersley Range] NP, Jul 1980, *Atkins & Wurm HI-728* (PERTH); Karijini [formerly Hamersley Range] NP, Jan 1985, *Cunningham 6* (PERTH); Yandicoogina, Sep 1980, *Gibbons 73* (PERTH); about 85 miles [c. 137 km] S of Munjina Roadhouse on Newman Road on site 121, Sep 1995, *Yan PRP637* (BRI); Paraburdoo Flats, Paraburdoo, Feb 1979, *Atkins 379* (PERTH); Nanjilgardy Pool, E of Paraburdoo, Apr 1985, *Mattiske EMCH1620* (PERTH); 3.7 km E of Mt Channar, 8.2 km NNW of Snowy Mountain, 42.2 km SE of Paraburdoo, Turee Creek Station, Jun 2006, *van Leeuwen et al. PBS0396* (PERTH); 6 km SE of Ashburton Downs, Sep 1979, *Toelken 6350* (BRI, PERTH).

Distribution and habitat: *Bonamia pilbarensis* occurs in the Pilbara Region of Western Australia from around Karratha, south to Ashburton Downs and east to the Marble Bar area (**Map 1**). It grows in *Spinifex* grassland, often with scattered eucalypts and acacias, on stony undulating country, often of basaltic origin, in stony clay to clay loam soils.

Phenology: Flowers have been recorded in January, April and September, with fruit in April, July and September.

Affinities: *Bonamia pilbarensis* is similar to *B. alatisemina* R.W.Johnson in having seeds with a narrow wing. It differs from *B. alatisemina* in having leaves elliptic to broadly elliptic or ±orbicular in outline and longer petioles. *Bonamia pilbarensis* has been previously confused with *B. media* but is clearly distinguished from it by having wing seeds. These differences are summarized in **Table 2**.

Notes: The typical form of this species has a moderately dense indumentum of ferruginous hairs on the stems and leaves with the subtending surfaces visible giving the plants a green to bluey-green appearance. A variant occurring from just south of Port Hedland to the Marble Bar area has a denser indumentum

Table 2. Comparison of some morphological characters between *Bonamia pilbarensis*, *B. alatisemina* and *B. media*.

Character	<i>B. pilbarensis</i>	<i>B. alatisemina</i>	<i>B. media</i>
Petiole length (mm) petiole:leaf blade ratio	5–10 0.3–0.7	0.5–1.5 0.01–0.04	2–8(–11) 0.1–0.3
Leaf blade shape	elliptic to broadly elliptic or ±orbicular	linear to very narrowly ovate	variable in shape mostly ovate, elliptic- ovate, oblong-ovate, ovate-lanceolate
Seeds	winged	winged	wingless

of white hairs giving the plants a silvery appearance (e.g. *Halford Q9165* (BRI); *Bean 25195* (BRI, PERTH); *Groves 8* (PERTH); *Coultas 21-6*, & *30-3* (PERTH); *Carroll 4* (PERTH)).

Conservation Status: *Bonamia pilbarensis* is a widespread species in the Pilbara, Western Australia and not known to be threatened.

Etymology: The specific epithet refers to the region in Western Australia in which it grows.

5. *Bonamia toniae* R.W.Johnson **sp. nov.**, quoad vestimentum formaque foliorum *B. brevifoliae* similis autem seminibus distincte alatis secedenda. **Typus:** Queensland. COOK DISTRICT: Normanby Range, Battlecamp Road, NW of Cooktown, 23 April 2013, *K.R. McDonald KRM14100* (holo: BRI [2 sheets], iso: CANB, DNA, K, MEL, *distribuenti*).

Perennial plant with slender trailing branches; **branches** moderately to densely hairy, green; hairs biramous with spreading to erect arms 0.2–1 mm long. **Leaves** simple, petiolate; **petiole** 3–8 mm long, 0.2–0.5 times as long as blade; **blade** discolorous, ovate to broadly ovate, 10–28 mm long, 8–22 mm wide, length:breadth ratio 1–1.9, apex obtuse to rounded, apiculate, base cordate; with a midrib and 3–5 pair of secondary veins usually distinct on lower surface; upper surface green, moderately hairy, glabrescent, hairs with ascending arms 0.2–0.7 mm long; lower surface silvery brown, densely hairy, hairs with appressed to ascending arms 0.1–0.4 mm long rarely longer. **Inflorescence** axillary, cymose, 1–(2–3)-flowered; **peduncle** ±absent up to 0.5 mm long; **bracts** linear, 1–4

mm long, *c.* 0.3 mm wide, moderately hairy, persistent; **pedicels** 2–5 mm long. **Outer sepals** ovate, 5.9–6.5 mm long, 2.6–2.8 mm wide, slightly longer and broader in fruit, length:breadth ratio 2.1–2.3, acute, obtuse at the base, densely hairy; **inner sepals** ovate, 5–5.6 mm long, 2.5–3 mm wide, slightly larger in fruit, length:breadth ratio 1.7–2, acute or acuminate, truncate to sub-cordate at the base, densely hairy along spine and tip with a hyaline basal margin. **Corolla** funnel-shaped, *c.* 5 mm long, *c.* 9 mm diameter, cream with pale yellowish centre; **petals** *c.* 9 mm long and 5 mm wide at limb, rounded, emarginate, apiculate; mid-petaline bands hairy for *c.* 5 mm from tip. **Stamens** 5; filaments unequal in length, adnate for *c.* 2 mm from base of corolla tube, free for 3.8–4.1 mm, fused-base winged, with tubercles and hairs to 0.05 mm long above and below the point of attachment; **anthers** oblong, 1.4–1.5 mm long 0.7–0.8 mm wide, rounded, emarginate at the apex, sagittate, with blunt basal lobes *c.* 0.5 mm long. **Ovary** oblong-globular, on a small disk, 2-locular, *c.* 1.2 mm long, densely hairy with erect hairs mainly confined to the upper half; **styles** 2, unequal in length, 4.5–5 mm long, connate in the lower *c.* 2.5 mm, glabrous, each with a sub-globose capitate stigma. **Capsule** ovoid, 5–7 mm long, 4.5–5 mm diameter, with a tuft of erect hairs to 1 mm long at the tip, circumscissile and 4-valved; **seeds** 3–3.5 mm long, 1.8–2.3 mm across, glabrous, finely punctate, light brown to yellow brown, with a narrow undulate wing along one or both margins; wing slightly paler than seed surface, up to 0.1 mm wide. **Figs.** 2E, 5H–K, 8.



Fig. 7. Holotype of *Bonamia pilbarensis* [Mitchell PRP217 (BRI)].

Additional specimens examined: Queensland. COOK DISTRICT: Harkness Station, W of Dixie, Jul 2008, McDonald KRM7807 & Wamman (BRI); Battlecamp Road, W of Hopevale, Normanby Range, May 2008, McDonald KRM7704 & Covacevich (BRI); Fairview – Kimba Road, 18 km W of Peninsula Development road, Apr 1980, Johnson 4025 (BRI).

Distribution and habitat: Known from three locations on Cape York Peninsula, north Queensland, Harkness Station (W of Dixie), on the Fairview – Kimba Road W of the Peninsula Development road, and in the Normanby Range (W of Hopevale) (Map 2). It grows on alluvial flats and creeklines in eucalypt woodland on sandy soils.

Phenology: Flowers have been recorded in April, with fruits from April and July.

Affinities: *Bonamia toniae* is similar to *B. brevifolia* in vestiture and leaf shape, but differs from that by having distinctly winged seeds.

Conservation Status: *Bonamia toniae* is known from three localities in southern parts of Cape York Peninsula. There is insufficient data on population sizes and area of extent to assess the species conservation status.

Etymology: Named in honour of my wife, Toni Johnson.

6. *Bonamia wilsoniae* R.W.Johnson sp. nov., similis *B. mediae* speciei per Australian borealem late extendenti autem colore longitudine diametrica corollorum: albae 5–10 mm longae 15–17 mm diam. (vice albae rare cyaneae 8–11 mm longa 6–8 mm diam. in *B. media*) majore ratione petiolo/lamina folii (0.35–0.55 vice 0.1–0.3 in *B. media*) habitu generatim graciliore ab eam differt. **Typus:** Northern Territory. DARWIN AND GULF REGION: UDP Falls [Gunlom Falls], Waterfall Creek Nature Park [now part of Kakadu National Park], 9 May 1983, K.L. Wilson 5231 (holo: BRI; iso: DNA, NSW, distribuendi).

Perennial with trailing stems from a slender taproot, **stems** slender, moderate to sparsely hairy; hairs biramous with decumbent to ascending arms, arms 0.1–0.5 mm long. **Leaves** simple, petiolate; **petiole** 2–14 mm long, 0.35–0.55 times as long as the blade; **blade** ovate, oblong-ovate to

orbicular, 3–33 mm long, 4–18 mm wide, length:breadth ratio 1.5–2.5, apex acute to rounded, mucronulate, base truncate to subcordate; midrib and 3–5 pairs of secondary veins distinct on lower surface; sparsely to moderately densely hairy on both sides, hairs with decumbent to ascending arms 0.1–0.5 mm long. **Inflorescence** axillary, cymose with 1 (rarely 2) flowers; **peduncle** ±absent; **bracts** opposite, narrow linear, 1–2 mm long, 0.1–0.2 mm wide, persistent; **pedicel** 1.5–5 mm long. **Outer sepals** ovate, 4.5–6.3 mm long, 2–2.7 mm wide, length:breadth ratio 2–2.7, apex acute, base rounded to truncate, moderately hairy, hairs with arms 0.25–0.5 mm long; **inner sepals** narrowly ovate, 4–6 mm long, 2–2.4 mm wide, length:breadth ratio 2.5–2.6, apex somewhat acuminate, base subcordate, hairy along the medial line with a glabrous, hyaline margin at the base. **Corolla** funnel-shaped, 5–10 mm long, 6–8 mm diameter, blue with a white throat; **petals** 7.5–11 mm long, 3.5–4.5 mm across at the limb, distally rounded, emarginate, midpetaline bands hairy for 4–7.5 mm from the tip. **Stamens** 5; filaments unequal in length, adnate for 1.2–1.7 mm from the base of the corolla tube, free for 2–4 mm, fused-base winged with scattered hairs and tubercles mainly on the margin and extending above the point of attachment; **anthers** ovate-oblong to oblong-elliptic, 1–1.25 mm long, apex emarginate, base sagittate, basal lobes 0.4–0.5 mm long. **Ovary** ovoid, on a small disk, 2-locular, c. 1.2 mm long, glabrous, except for long hairs towards the tip; **styles** 2, unequal, 3–6 mm long, connate in the lower 2–3 mm, glabrous, each with a subglobose-capitate stigma. **Capsule** globular-ovoid, 4–4.5 mm long, 3.5–4 mm diameter, circumscissile, 4–8-valved, with some hairs at the apex; **seeds** 2.2–2.8 mm long, 1.5–2 mm across, glabrous, granular, mid-brown to black, wingless. **Figs. 2F, 3A–D, 9.**

Additional specimens examined: Western Australia. Hidden Valley, 2.5 km NNE of Kununurra, Apr 1983, Wilson 4792 (NSW). **Northern Territory.** VICTORIA RIVER REGION: Gregory NP, 100 km SSW of Bullita Ranger Station; on Midnight Creek, Apr 1996, Foreman & Duretto 2151 (DNA, MEL); Spirit Hills Conservation Area, Nancys Gorge, Aug 1996, Cowie 7158 (DNA). DARWIN AND GULF REGION: Fitzmaurice River, upper catchment, May 1994, Dunlop & Barritt 10063 (DNA);



Fig. 8. Holotype of *Bonamia toniae* [McDonald 14100 (BRI)].

Macadam Range, Feb 1994, *Leach 4195* (DNA); Nitmiluk NP, Mar 2001, *Michell 3352* (DNA); Edith Falls, Apr 1995, *Egan 4743* (DNA).

Distribution and habitat: It is known from the southern part of Kakadu NP, south to Gregory NP extending into Western Australia near Kununurra (**Map 2**). It grows in broken sandstone country on rocky soils in shaded areas beside creeks.

Phenology: Flowers and fruit have been recorded in April and May.

Affinities: *Bonamia wilsoniae* is morphologically similar to *B. media*, a widespread species throughout northern Australia. It differs from *B. media* in having blue corollas which are generally smaller in length and diameter, (5–10 mm long, 6–8 mm diameter versus corolla white or rarely blue, 8–11 mm long, 15–17 mm diameter for *B. media*), a larger petiole to leaf blade ratio (0.35–0.55 versus 0.1–0.3 for *B. media*), and generally a more slender habit.

Conservation Status: *Bonamia wilsoniae* appears to be a rare species, growing in specialised habitats but its conservation status is unknown.

Etymology: Named in honour of Karen Louise Wilson, (1950–) who collected the type and whose extensive collections of Convolvulaceae have greatly assisted me in my studies.

Acknowledgements

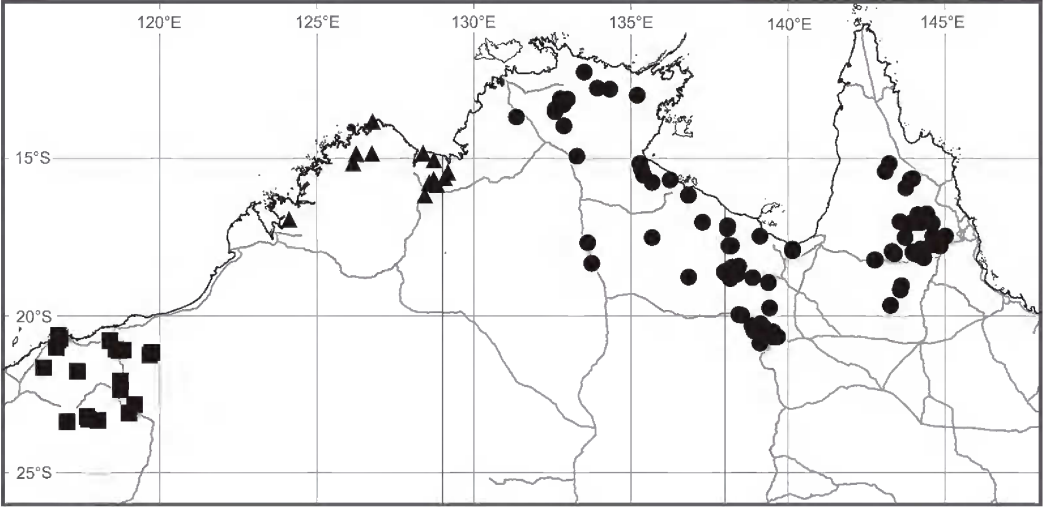
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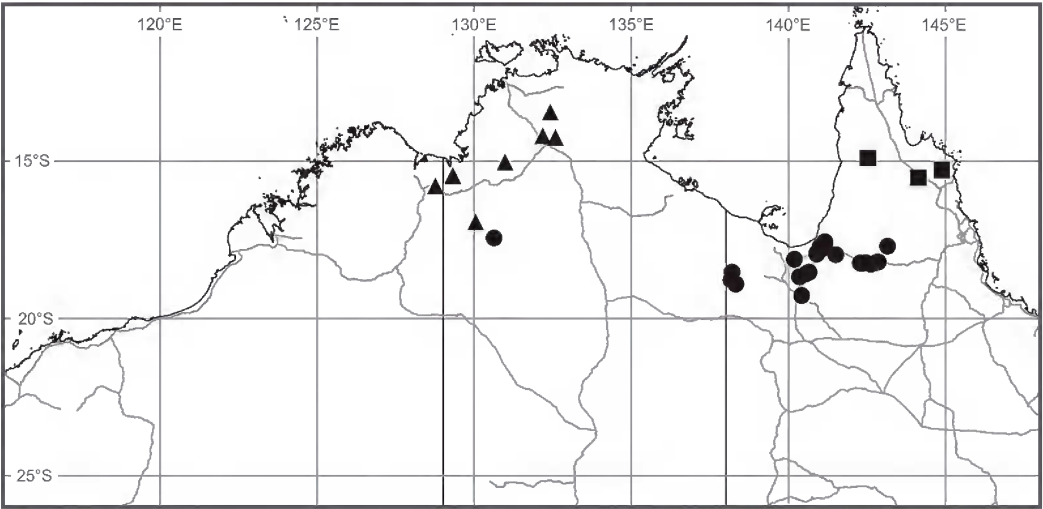
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Fig. 9. Representative specimen of *Bonamia wilsoniae* [Egan 4743 (DNA)].



Map 1. Distribution of *Bonamia fruticosa* ▲, *B. multiflora* ● and *B. pilbarensis* ■.



Map 2. Distribution of *Bonamia longipilosa* ●, *B. toniae* ■ and *B. wilsoniae* ▲.